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Small-scale water harvesting in Northern Ethiopia: Can it improve household welfare without compromising health?

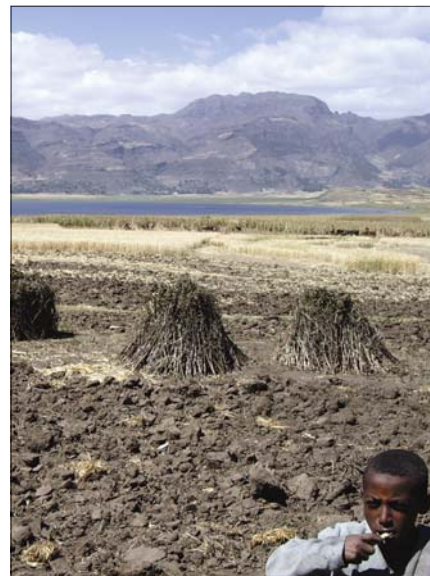
Overview

Ethiopia is one of the most drought prone countries in the world. Yet much of Ethiopia's economy depends upon adequate and reliable rainfall for agricultural production. Over the years scanty and erratic rainfall has led to significant crop losses, and in some cases total crop failure. This means food crises and famine. Millions of Ethiopians have been affected. Half the population is chronically poor and nearly one quarter of children born do not reach the age of five. Higher temperatures due to climate change only exacerbate the pressure on Ethiopia's already fragile ecosystems.

In order to fight poverty and famine by providing food security, effective development of water resources is vital for Ethiopia. Water harvesting is one strategy used to increase agricultural productivity and household income. Historically, water harvesting in Ethiopia dates back to 560 BC, where rainwater was harvested and stored in ponds for agricultural and water supply purposes. These days, the construction of ponds and wells aims to make water available to irrigate and produce higher value crops, as well as provide water for livestock and household use.

But the benefits of water harvesting may come at a cost: Malaria. It is a major public health problem in Ethiopia where it contributes up to 20 percent of under-five deaths. Mosquitoes breed in areas of standing water, so extensive construction of ponds and water wells is likely to increase the number of available mosquito habitats. More mosquitoes mean an increase in the intensity of malaria transmission as well as a longer transmission period.

This study explores the range of negative health impacts associated with water harvesting in the Tigray region of northern Ethiopia. Our results show that ponds and wells are important factors in determining the prevalence of malaria. Households' willingness to pay for improved malaria control is influenced by various factors. Ponds and wells are not yet exploited to their fullest potential, as they are not significantly contributing to household income or welfare. This means that water harvesting structures could pose a high external cost to the economy.



Issues facing policy-makers:

- Does the implementation of ponds and wells increase the probability of water-born diseases, such as malaria? What are the welfare and economic consequences of malaria for poor households?
- How effective are the current options for malaria control in Tigray? What cost-effective solutions can be implemented in the future?
- Does water harvesting improve household welfare to the extent that households are willing and able to pay for improved malaria control?



Study Area

Ethiopia is located in the Horn of Africa and is bordered by Eritrea, Djibouti, Somalia, Kenya and Sudan. With a population of 75 million people it is the second most populous country in Africa. Ethiopia is divided into nine administrative regions, the northernmost of which is Tigray. About 4 million people live here, most of who are farmers. Tigray has a semi-arid climate with scanty and erratic rainfall that remains insufficient for crop production. Since 2003, household water harvesting schemes have been expanding as an integral part of the Tigray regional food security and extension programmes, aimed at breaking the cycle of famine. Malaria is already a major public health problem in Tigray. About 75% of the region is malarious with more than half of the population at risk of contracting the disease. The study draws on data collected from 650 households within thirteen tabias (villages). The tabias were selected on the basis of i) differences in agro-ecology (lowland, middle altitude and highland); ii) presence of ponds and water wells; iii) distance to market and iv) the availability of baseline information.



The approach

A range of qualitative and quantitative research methods was used to collect and process information. A large-scale survey of 650 farm households was conducted in Tigray to collect information regarding location of village water bodies, household characteristics, mosquito abundance in different breeding sites and prevalence of malaria infections. Control sites were those villages containing households without access to ponds and wells. We used the contingent valuation (CV) method and a double bounded dichotomous choice CV survey with 250 of these households to find out if people were willing to pay for improved malaria control. The results were statistically analyzed using probit estimation, regression analysis and interval regression.

Key findings

1. Malaria is a major public health problem

In almost all of the sites malaria prevalence is very high, particularly in low land communities where it exceeds 30 percent (see Table 1). A prevalence rate in excess of 5 percent is considered an epidemic. There are more cases of malaria in households that have access to wells as opposed to ponds. This might be due to the fact that wells are used all year round, whereas ponds are only in operation for a few months of the year.



2. Prevalence of malaria is influenced by several factors

These key factors are:

- **Altitude:** low land communities are more at risk than those located at higher altitudes.
- **Seasonality:** malaria prevalence rate is much higher directly after the rainy season (November and December).
- **Wall type of house:** Houses made from wood, mud and other materials are more at risk than houses made from brick.
- **Toilets:** Open use of toilets significantly increases the incidence of malaria.
- **Livestock ownership:** Livestock attract mosquitoes which increases the incidence of malaria.
- **Location of wells:** the closer the well is located to the house, the greater the incidence of malaria.
- **Using bed nets** (less than 10 percent of respondents use nets) and **listening to the radio** significantly reduces the probability of malaria incidents, as people become aware of preventative measures. The main preventative strategy is disturbing mosquito habitats (92 percent).



The average income foregone as a result of being ill is Birr 12.6 per day while the average number of working days foregone is estimated at 62 days. This means that on average, malaria costs a poor household Birr 1,000 each year (about 25 percent of mean annual income).

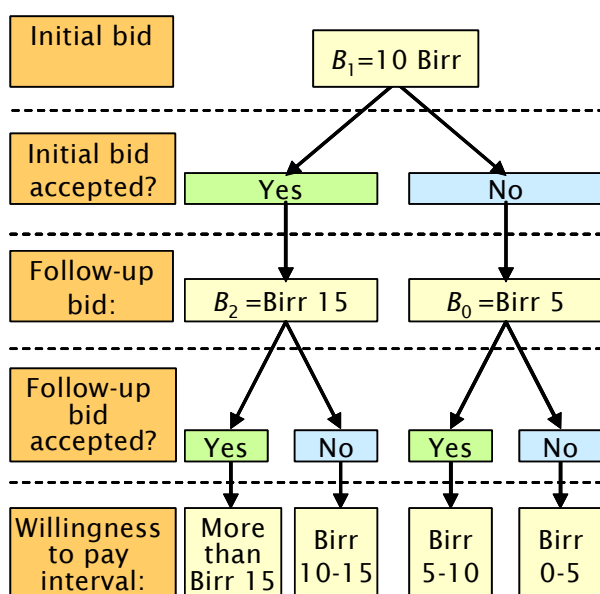


Table 1: Malaria prevalence of intervention and control sites.

3. The financial consequences of malaria for poor households are serious

Household income foregone due to family members not being able to work combined with the cost of medical treatment is difficult for poor households to cope with. Health related expenses (medicine, doctors' visits and transport to health centre) are estimated at Birr 237 per year.

4. Poverty means that few people are willing to pay for improved public health services

The results show that access to either ponds or wells is not reflected in higher levels of willingness to pay for improved public health services (i.e. improved malaria control). Less than half of the respondents were willing to pay. One of the reasons might be that ponds and wells are not currently exploited to their full extent, and do not significantly improve household welfare enough for people to see a tangible increase in income. The majority of people who were not willing to pay for improved health services stated they were too poor to afford the payment, even if households understood the serious implications malaria poses to their health and financial wellbeing.

5. Key factors affect households' willingness to pay for improved public health services

Interestingly, households with access to wells are more willing to pay than households who own ponds, indicating differences in their economic attractiveness. Wealthier households (those that own livestock) are willing to pay higher amounts for improved malaria control. The maximum mean WTP is Birr 3.8 per month (equal to about one third of a day's work). Households located in highland areas are less vulnerable to malaria and therefore less willing to pay, compared to households located in low land areas. The presence of a malaria-sick household member increases a household's willingness to pay.

Solutions for policy makers

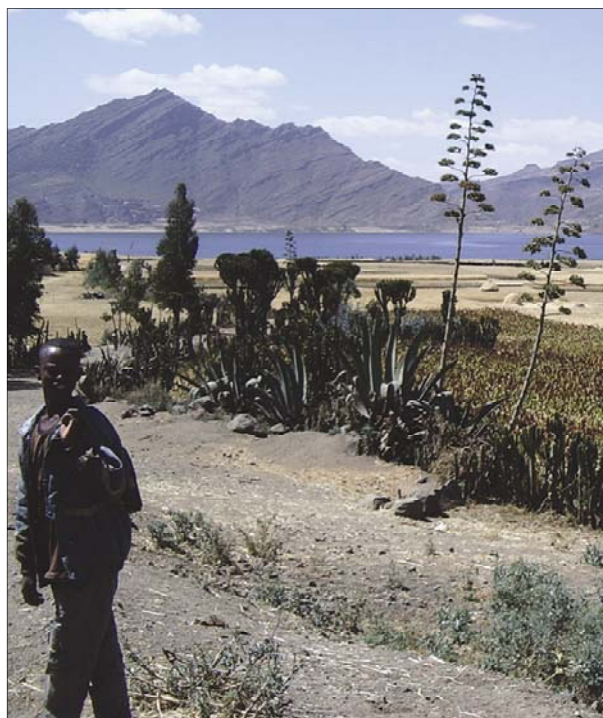


Malaria control measures need to be implemented alongside water development strategies such as water harvesting. In order to target those households that are most vulnerable to malaria, we advise the following:

- **Prioritize villages** located in low and mid-altitude areas.
- Ensure that households located close to wells have the resources and knowledge to implement malaria prevention techniques (use bed nets, cover well when not in use, regularly disturb breeding ground etc). The provision of **bed nets for poor households** could significantly reduce the incidence of malaria.
- Due to the strong **seasonal nature** of malaria, special measures should be implemented during the **peak seasons**. For example, a targeted radio campaign can provide information at relevant times of the year.
- Preventative measures can be implemented with the construction of **new dwellings**, where choice of suitable wall type and toilet facilities can make a difference.

- **Livestock husbandry** needs to be considered when designing malaria control measures. This could include construction of detached cattle sheds from human domicile as opposed to the usual manner of humans and cattle living together in close proximity.

Currently, ponds and wells are not being exploited to their fullest economic potential. This is especially true of ponds and there is a need to closely monitor ponds and wells in the near future. If household ponds and wells fail to yield their full economic potential, then they pose a high external cost to the economy.



PREM: In brief

The Poverty Reduction and Environmental Management (PREM) programme aims to deepen and broaden the exposure of economic researchers and policy advisors in Africa and Asia to the theory and methods of natural resource management and environmental economics. It is anticipated that this will encourage policy changes that address both poverty reduction and sustainable environmental management.

This policy brief is based on the PREM project 'Water-harvesting for poverty reduction and sustainable resource use: Adaptation strategies to climatic change in Tigray region, Ethiopia'

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The full paper is available online at:
www.prem-online.org

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